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BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Administrator Of General Services

GSA Could Do More To Improve Energy Conservation In New Federal Buildings

Newly constructed Federal buildings have used 20 percent to 203 percent more energy annually than they were designed to consume. GSA has rejected some Federal building designs because of such problems as inadequately designed energy conservation features. GSA has started actions to improve the design process, but to provide greater assurance that the energy usage goals will be met, GSA needs to

- make known to future building designers its experiences gained about energy conservation on prior projects and
- increase its commitment to designing energy conservation in new Federal buildings.



118925

GAO/PLRD-82-90
JULY 12, 1982

022703/118925

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT, LOGISTICS,
AND READINESS DIVISION

B-207959

The Honorable Gerald P. Carmen
Administrator of General Services

Dear Mr. Carmen:

This report identifies the problems that might adversely affect the General Services Administration's ability to reduce energy consumption in newly designed Federal buildings. We reviewed the area of designing energy efficient buildings because of the known successes, failures, and problems in General Services' energy conservation demonstration project, the Norris Cotton Federal Building in Manchester, New Hampshire, and the excessive consumption of energy in subsequently completed Federal buildings.

The report contains recommendations to you on pages 10 and 21. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Chairmen, Senate Committees on Governmental Affairs and on Environment and Public Works; House Committees on Government Operations and on Public Works and Transportation; Subcommittee on Energy Conservation and Power, House Committee on Energy and Commerce; and Subcommittee on Energy Conservation and Supply, Senate Committee on Energy and Natural Resources; the Director, Office of Management and Budget; and other parties who have an interest in this matter.

Sincerely yours,

A handwritten signature in cursive script that reads "Donald J. Hopan".

Donald J. Hopan
Director



D I G E S T

Federal buildings completed since fiscal year 1979 have been using significantly more energy annually than they were designed to consume. The General Services Administration (GSA) is aware of some of the problems that have caused excessive energy usage in these buildings, such as air infiltration, and has taken actions to improve energy conservation in future and existing buildings. Actions include basing energy usage budgets on local conditions and current technology, developing procedures to diagnose air infiltration in buildings, and realigning responsibilities for managing the overall quality of designs. These actions are first steps; however, significant benefits may not be forthcoming unless GSA takes additional actions to improve communications between architect-engineer firms and GSA offices. In addition, GSA should commit sufficient resources to implement programs that affect energy conservation designs and adequately emphasize energy conservation matters. (See pp. 2, 12 through 14, and 19.)

Ineffective communications concerning energy conservation requirements among GSA's Central Office, its regional offices, and architect-engineer firms is one reason the firms are submitting unsatisfactory designs. This condition exists even though GSA has issued guidelines and criteria for its energy conservation requirements and offers any assistance necessary to help architect-engineer firms achieve the building energy usage goals. (See pp. 8, 9, and 14 through 17.)

The Norris Cotton Federal Building in Manchester, New Hampshire, is GSA's energy conservation demonstration project. The successes, failures, and problems experienced in this building are not made known by GSA to others for consideration in designing new Federal buildings. GSA said that many of the experiences gained were outdated. GAO believes, however, that the knowledge gained from this building might help designers avoid problems with energy conservation. (See p. 6.)

Another contributing factor causing unsatisfactory designs is that regions, in reviewing design submissions, generally do not have adequate

knowledge of energy conservation technology to ensure the submissions comply with GSA requirements. This point is important for implementing GSA's revised management of the design process because the regions are responsible for conducting indepth reviews of architect-engineer firms' design submissions. (See pp. 19 and 20.)

Other factors that contribute to unsatisfactory designs and that need to be improved are (1) the Central Office having no assurance that problems identified will be solved because the regions are not required to implement the corrective actions, (2) the failure to conduct all planned post-occupancy evaluations, (3) a delay in completing the instructions implementing the revised management for processing designs, and (4) the lack of a standard for evaluating energy conservation expertise when selecting architect-engineer firms. (See pp. 16, 17, 19, and 20.)

Because of budget restrictions, GSA needs to place more emphasis on the program to improve the design process, so that new Federal buildings are energy efficient. Therefore, the Administrator of General Services should identify the specific needs of his energy design review staff and provide the training necessary to fulfill their educational needs. He should also take steps to complete and implement the procedures for controlling the quality of designs so that new Federal buildings are designed to conserve energy. (See p. 21.)

RECOMMENDATIONS

The Administrator of General Services should require the Commissioner, Public Buildings Service, to:

- Summarize the successes, failures, and problems experienced in the Norris Cotton Federal Building into a document, showing how this knowledge can be applied to other new Federal buildings, and provide this document to designers of other Federal buildings.

- Incorporate into the energy conservation guidance provided to architect-engineer firms, the experiences gained on projects constructed after the Norris Cotton Federal Building.

- Provide the training necessary in GSA's energy conservation requirements and state-of-the-art energy conservation technology for the regional energy design review staff to perform their duties.
- Promptly implement the procedures for the revised policy to improve the quality of designs.
- Implement the post-occupancy evaluation program with specific attention to energy conservation matters.
- Establish a standard, with minimum and maximum values, for evaluating energy conservation expertise when selecting architect-engineer firms.

AGENCY COMMENTS

GSA generally agrees with GAO's recommendations (see app. II) and has revised its process for selecting concept designs by requiring the regions to obtain Central Office concurrence. However, GSA does not agree with GAO's recommendation to provide designers of Federal buildings the knowledge gained from the Norris Cotton Federal Building. GSA believes that many of the design elements cannot be transferred to other buildings. GAO does not advocate this. However, GAO believes that the successes, failures, and problems experienced in the Norris Cotton Federal Building might help designers of other Federal buildings.



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ABBREVIATIONS

A/E	architect-engineer
BTU/GSF	British thermal units per gross square foot
GAO	General Accounting Office
GSA	General Services Administration
NBS	National Bureau of Standards

CHAPTER 1

INTRODUCTION

The General Services Administration (GSA) is responsible for designing, constructing, and operating all public buildings, primarily Federal office buildings, in the United States. In recent years, GSA's construction program has been relatively small, and only a few new Federal office buildings have been constructed. However, legislative efforts are underway which, if successful, would greatly increase the size of the construction program. GSA's current long-range construction plan, which anticipates passage of pending legislation, proposes about \$2.5 billion for fiscal years 1982 through 1988, as follows:

<u>Fiscal year</u>	<u>Amount</u>
	(millions)
1982	\$ 69.9
1983	68.4
1984	315.8
1985	352.0
1986	411.1
1987	569.6
1988	<u>719.7</u>
Total	<u>\$2,506.5</u>

GSA'S ATTEMPTS TO IMPROVE
ENERGY CONSERVATION DESIGNS
OF NEW BUILDINGS

Executive Order 12003, dated July 20, 1977, requires GSA, along with all other agencies, to reduce by 1985 the energy consumed in new buildings by 45 percent based on the average 1975 consumption in similar buildings. GSA has taken two significant actions to improve energy conservation in new buildings. In fiscal year 1972, it started planning the Norris Cotton Federal Building as an energy conservation demonstration project, and in fiscal year 1979, it established energy usage goals for new Federal buildings based on local conditions and current technology.

The Norris Cotton Federal
Building energy conservation
demonstration project

In fiscal year 1972, the Administrator of General Services initiated action to design and construct the Norris Cotton Federal Building in Manchester, New Hampshire. The building, which was completed in 1976, was used as a laboratory for testing and evaluating energy conservation methods in office buildings.

The design of the building is substantially different from designs of conventional office buildings and includes both recognized and innovative energy conservation features. Among the building's unique features are:

- Fin-like granite panels surrounding the windows fixed in a position that reflects in sunlight during winter, blocks out sunlight in the summer, and breaks up strong winds.
- Small window areas to reduce heat loss, with special double glazed windows with venetian blinds built between the window panes, and no windows on the north side.
- Massive exterior walls with the insulation on the exterior side between the masonry and facing panels to minimize the effects from outdoor temperature.
- A variety of interior energy-efficient illumination systems.
- Innovative energy-conserving heating, air-conditioning, and ventilating systems which include heat pumps, heat storage and recovery devices, and liquid-heating solar collectors.

Energy usage goals based on local conditions and current technology

GSA has established energy usage goals for its buildings. Between fiscal years 1974 and 1979, GSA used the annual energy usage goals of 55,000 British thermal units per gross square foot (BTU/GSF) at building boundaries 1/ and 100,000 BTU/GSF at energy sources 2/ for all new building designs. The energy usage goal at energy sources, however, was not intended to be a forecasting target against which actual performance is measured. These goals were based on the experience from designing the Norris Cotton Federal Building.

In fiscal year 1979, GSA attempted to increase energy savings in new buildings by establishing different, and generally lower, energy usage goals for each new building. These new

1/Energy used at building boundaries is the amount of energy, such as kilowatt-hours of electricity or cubic feet of gas, used by each building as shown on monthly billings from utility companies, and converted to BTU/GSF by GSA.

2/Energy used at the source is the total amount of energy, such as tons of coal or gallons of fuel oil, used by utility companies to produce the kilowatt-hours of electricity used by buildings, as discussed in note 1 above and converted to BTU/GSF by GSA.

goals are based on site condition, climate, occupancy, and current technology rather than the standard annual usage goal of 55,000 BTU/GSF. GSA says that designers can attain the newly established goals by using computer modeling, passive solar features, insulation, heat reclamation, glazing, high-efficiency mechanical and electrical systems, and energy monitoring and control systems.

Since September 1979, GSA has awarded contracts to design the following Federal buildings to meet these newly established energy usage goals.

<u>Building</u>	<u>Architect-engineer contract award date</u>	<u>Annual energy usage goals</u>	
		<u>Building boundary</u>	<u>Energy source</u>
(BTU/GSF)			
Courthouse and Federal Office Building Springfield, Massachusetts	a/3-27-79	31,000	78,000
Courthouse and Federal Office Building San Jose, California	8-29-80	25,000	73,000
Federal Office Building and Parking Facility El Paso, Texas	5-19-81	88,000	255,000
Federal Office Building and Parking Facility Savannah, Georgia	5-21-81	32,000	87,000
Federal Office Building Boston, Massachusetts	8-17-81	31,000	78,000

a/The annual energy usage goal was 55,000 BTU/GSF when the contract was awarded and revised to 31,000 BTU/GSF in Sept. 1979.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our objective was to determine whether GSA was reducing energy consumption in newly designed Federal buildings to meet the standards specified in Executive Order 12003. We examined GSA's efforts to ensure that designers of new Federal buildings were adequately considering (1) the experiences gained regarding energy conservation features incorporated in the Norris Cotton Federal Building and (2) other state-of-the-art energy conservation features.

We performed the review primarily at GSA's Central Office, Washington, D.C.; and Region 1, Boston, Massachusetts; Region 2, New York, New York; Region 4, Atlanta, Georgia; and Region 9, San Francisco, California. We also met or contacted architect-engineer (A/E) firms located in these regions. We performed our work in accordance with our current "Standards for Audit of Governmental Organizations, Programs, Activities, and Functions."

We reviewed Executive Order 12003 and GSA's orders, guidelines, memorandums, and reports which comprise GSA's policies and procedures regarding the design of energy conservation features in new buildings. We supplemented this data with reviews of project files and interviews with representatives of GSA and A/E firms to find out if GSA's policies, procedures, and practices were adequate to ensure that new buildings were designed to be energy efficient.

We reviewed six GSA office building projects that were in various stages of design and construction. We used evaluation reports prepared by GSA and a consultant of the designs for these buildings to see if any problems existed regarding designs of energy conservation features and the actions taken by GSA and the A/E firms to resolve them. We also used the National Bureau of Standards' (NBS's) evaluation reports on the energy conservation features designed into the Norris Cotton Federal Building to determine whether the experiences gained from the project were adequately considered in the design of other buildings. (See app. I for a listing of these evaluations.) The six building projects we reviewed were:

<u>Region</u>	<u>Building</u>	<u>Location</u>
1	Federal Office Building	Boston, Massachusetts
1	Courthouse and Federal Office Building	Springfield, Massachusetts
2	Social Security Administration Program Center	Jamaica-Queens, New York
4	Federal Office Building and Parking Facility	Savannah, Georgia
7	Federal Office Building and Parking Facility	El Paso, Texas
9	Courthouse and Federal Office Building	San Jose, California

We also reviewed the actual energy consumption for another six Federal buildings designed and constructed since the Norris Cotton Federal Building was completed. Our purpose was to determine the adequacy of the design, or other factors, of these buildings regarding energy conservation by comparing actual energy usage with the design estimates. The other six buildings were:

<u>Region</u>	<u>Building</u>	<u>Location</u>
3	Federal Building and Parking Facility	Norfolk, Virginia
4	Federal Building, Courthouse and Parking Facility	Fort Lauderdale, Florida
4	Federal Building	Jackson, Mississippi
4	Federal Building and Courthouse	Columbia, South Carolina
5	Federal Building	Carbondale, Illinois
10	Federal Building, Courthouse and Parking Facility	Anchorage, Alaska

CHAPTER 2

EXPERIENCES GAINED FROM THE NORRIS COTTON

FEDERAL BUILDING COULD BENEFIT OTHER DESIGNERS

The Norris Cotton Federal Building in Manchester, New Hampshire, generally met the broad objectives of providing a laboratory for energy conservation techniques and equipment and fostering energy conservation in new Federal buildings. However, the experiences gained from applying energy conservation features and the extensive corrective actions that were taken to make the building energy efficient were not made known by GSA to designers for consideration in designing new Federal buildings.

GSA said that many of the experiences gained were outdated because of advances in energy conservation state of the art. GSA also said that NBS's evaluations of the building's systems were highly technical and voluminous and that GSA lacked the staff time to summarize the data for use by others.

GSA has been rejecting A/E firms' design submissions because of such problems as inadequately designed energy conservation features. There may not always be a correlation between the experiences gained from the Norris Cotton Federal Building and unsatisfactory designs for subsequently designed buildings. However, we believe that GSA needs to make known to designers the experiences gained from applying energy conservation features in the Norris Cotton Federal Building, as well as those experiences gained in designing other Federal buildings. In this way, designers would be able to take advantage of the successes and failures of prior projects and avoid the delays caused when designs are rejected as inadequate.

EXPERIENCES GAINED HAVE BEEN DOCUMENTED

NBS participated with the design team to design energy conservation features in the Norris Cotton Federal Building. NBS evaluated the completed building's systems and published 20 reports and articles from 1975 to 1981. Although GSA used project data initially to establish a standard energy usage budget, it has not provided the data from the reports and articles to the regions for consideration in designing new Federal buildings.

The Norris Cotton Federal Building was designed for multi-agency use and the contract to design the building was awarded on November 7, 1972. The Administrator of General Services designated the building an energy conservation demonstration project and awarded another contract on December 11, 1972, to an energy conservation consultant to serve as a member of the design team. The consultant was to develop recommendations on energy conservation features to include in the architect's design for the building.

GSA also required the energy conservation consultant to prepare, as a separate project, a handbook entitled "Energy Conservation Guidelines for Federal Buildings." This publication was GSA's attempt to anticipate presidential or congressional actions regarding energy conservation. The guidelines cover similar energy conservation features and systems used in the Norris Cotton Federal Building, such as site development and building configuration and orientation, interior planning, construction materials, lighting, heating, ventilating, air-conditioning, domestic water, and solar energy utilization. The handbook is used by A/E firms that prepare designs for Federal buildings.

In addition to the energy consultant and building designer, GSA arranged with NBS to participate in selecting and evaluating the various building systems to be used in the Norris Cotton Federal Building. NBS collaborated with the energy consultant, assisted in determining the size of the heating and cooling systems, designed and operated the system for measuring energy usage, prepared specifications for the computer system to compile energy data, and monitored the building's energy usage. NBS performed this work under an interagency agreement with the Department of Energy and issued 20 reports or articles over a 6-year period on its evaluations of the various building systems, 1/ and other factors, such as economic analysis and user acceptance. These reports generally describe the building's systems, such as its outer shell, and contain an evaluation of the energy conservation performance of these building systems and actions to improve the systems, such as recaulking the building's outer shell.

Objectives met only after extensive rework

The Norris Cotton Federal Building was designed to include many innovative energy conservation features, such as solar collectors, heavy masonry construction with exterior insulation, small overall window area, heat recovery systems, thermal storage tanks, lighting systems mounted on furniture, and an energy monitoring and control system. The building dramatized GSA's commitment to conserve energy and started a new generation of energy conserving Federal buildings.

The project demonstrated that a medium-sized office building could be designed and constructed to use no more than 55,000 BTU/GSF annually. However, to achieve this level of performance, it was necessary to recaulk the building facade and modify

1/These systems included the solar energy system, air exchange and ventilation systems, computer controlled data acquisition systems, lighting systems, and an energy monitoring and control system.

the outside air dampers, plumbing, engine-generator, and solar collectors. Certain modifications were required in the operations of the solar collectors, water chillers, gas-fired boilers, hot water heating system, and variable air volume system. In addition, it was necessary to add two manually controlled oil fired boilers. These changes were brought about as a result of NBS's evaluations of the building systems.

NBS emphasized the value of its evaluation reports when, 3 years after the Norris Cotton Federal Building had been in operation, it stated that:

- The performance of the building and the benefits from the study of the building would have been improved if certain lessons had been learned before the conception of the project.
- Designing a building as an experimental laboratory to compare the performance of a variety of energy conserving concepts generally was not compatible with designing a building for low energy use. In this building, several different energy conserving subsystems were installed and interconnected in such a way that the overall mechanical system was complex and difficult to control.

A/E firms' design submissions are unsatisfactory

Despite GSA's guidelines, A/E firms submitted designs that were unsatisfactory for energy conservation. GSA requires A/E firms to use its two publications for assistance in designing energy conservation in new buildings. One publication is GSA's handbook, "Energy Conservation Design Guidelines for New Office Buildings," which was prepared by the Norris Cotton Federal Building's energy consultant in January 1974 and updated in March 1977. The other publication is GSA's January 1977 order, "Criteria for a Federal Office Building." This order requires A/E firms to:

- Follow the guidelines in GSA's energy handbook, and other appropriate materials available to designers, to ensure that buildings will be energy efficient. However, A/E firms are also encouraged to exercise ingenuity in the development techniques for incorporation in office building designs.
- Forecast the energy usage of each new building. A/E firms are encouraged, and may be required, to use a comprehensive computer program to predict the energy requirements in BTU/GSF per year for the final design.

Despite these guidelines, A/E firms for the Springfield, Boston, El Paso, and San Jose projects had submitted designs that were unsatisfactory for energy conservation. GSA's Central Office cited the following reasons for rejecting the A/E firms' design submissions:

- The Springfield building task furniture lighting system was not acceptable because the studies of the Norris Cotton Federal Building showed the system to be inferior to other systems in energy consumption and quality of illumination. In addition, large amounts of glazing and poorly constructed walls allow high infiltration rates.
- The Boston building made no allowance for air infiltration, which is a significant modeling error.
- The El Paso building design had not considered using massive walls allowing for thermal savings between day and night.
- The San Jose building had not established energy conservation options associated with insulated wall systems. Rather, all energy conservation concepts were based on natural lighting.

EXPERIENCES STILL TO BE GAINED FROM THE DEMONSTRATION PROJECT

GSA recognizes that additional energy should be conserved in the Norris Cotton Federal Building and has contracted with an A/E firm to evaluate and analyze the existing mechanical, electrical, solar collector, computer and co-generation systems and provide a final report by the end of March 1982. This evaluation should state additional ways to conserve energy which, we believe, should be made available to designers of other GSA buildings.

CONCLUSIONS

Executive Order 12003 requires that Federal agencies aim to achieve a 45-percent reduction of energy usage from the level of fiscal year 1975. Several years before this requirement was instituted, GSA was concerned with conserving energy in new buildings and decided to build an energy conservation demonstration project that would be a laboratory for energy conservation technology and inspire others to build energy efficient buildings. The evaluation reports of the building showed that, generally, the project's objectives were met; however, many features and systems were not successful and required extensive corrective actions before the energy performance goal was met. Consequently, many reports and articles were published describing the energy conservation technology used and the experiences gained from applying this technology. However, the experiences gained were not made available to designers for consideration in designing other Federal buildings.

We believe that this information might have aided A/E firms in avoiding problems with energy conservation designs. Therefore, to help A/E firms improve their energy conservation knowledge, we believe that GSA should provide these firms, through GSA's regions, a summary of NBS evaluation reports of the Norris Cotton Federal Building and experiences gained about energy conservation on prior projects.

RECOMMENDATIONS

To ensure that designers of Federal buildings benefit from the experiences gained from applying energy conservation features in the Norris Cotton Federal Building, we recommend that the Administrator of General Services require the Commissioner, Public Buildings Service, to:

- Summarize the successes, failures, and problems gained from the Norris Cotton Federal Building into a document, showing how this knowledge can be applied to other new Federal buildings, and provide this document to designers of other Federal buildings.
- Incorporate into the energy conservation guidance provided to A/E firms, the experiences gained on projects constructed after the Norris Cotton Federal Building.

AGENCY COMMENTS AND OUR EVALUATION

GSA commented on a draft of this report on May 10, 1982 (see app. II). GSA agreed with our recommendation to incorporate into the energy conservation guidance provided A/E firms, the experiences gained on projects completed after the Norris Cotton Federal Building. However, GSA disagreed with our proposal that it summarize NBS publications that evaluate the energy conservation features in the Norris Cotton Federal Building and provide this information to designers of other Federal buildings. GSA stated that many design elements of the Norris Cotton Federal Building cannot, and should not, be transferred to other buildings in other climates. GSA agreed, however, to provide its regions two NBS publications: Building Science Series 130, dated January 1981, "User Acceptance of an Energy Efficient Office Building - A Study of the Norris Cotton Federal Office Building," and Building Science Series 133, dated August 1981, "Performance of the Norris Cotton Federal Office Building for the First Three Years of Operation."

We did not propose that design elements of the Norris Cotton Federal Building be transferred to other buildings. We believe, however, that NBS's published articles on the experiences gained from designing energy conservation features in this building would help designers of other buildings. Other publications that might help designers are: NBS report NBSIR 81-2358, dated September

1981, "Analysis of Data from the Energy Monitoring and Control System at the Norris Cotton Federal Office Building," and NBSIR 80-2093, dated November 1980, "Analysis of Computer-Simulated Thermal Performance of the Norris Cotton Federal Office Building."

We continue to believe that GSA should summarize the knowledge gained in the Norris Cotton Federal Building in a document and provide this to designers of other Federal buildings.

CHAPTER 3

PROBLEMS WITH ENERGY CONSERVATION

IN NEW FEDERAL BUILDINGS

Federal buildings constructed since fiscal year 1979 have used anywhere from 20 percent to 203 percent more energy annually than they were designed to consume. There are five probable causes for this excessive energy use: weather deviated significantly from the norm, inadequate design, poor construction, malfunctioning equipment, or improper occupant usage. All of these factors were present in the Norris Cotton Federal Building. We discuss the design issue below.

We observed problems which appear to have been caused by GSA's central and regional offices not adequately communicating to A/E firms the knowledge gained from previous uses of specific energy conservation features. According to GSA's Central Office energy design review staff, the designs for four of six projects still in progress did not adequately consider energy conservation features. The Central Office staff has authority only to suggest to the regions the actions necessary to correct the design problems, and therefore, has no assurance that the problems will be solved because the regions are not required to implement the corrective actions. Also, the regions generally do not have the technical expertise to adequately review A/E firms' energy consumption analyses and they place little emphasis on energy conservation expertise when selecting A/E firms.

To improve the quality of designs for new buildings, including energy conservation features, GSA has revised its policies for managing the design process. However, completion of the implementing procedures has been delayed from December 1981 to the end of fiscal year 1982 because of a lack of resources.

GSA's action is the first step toward improving the quality of designs for new Federal buildings. We believe, however, to help ensure that energy conservation features are designed in new buildings, GSA needs to take additional actions to improve communications among its offices. In addition, GSA should commit sufficient resources to implement programs that affect energy conservation designs and adequately emphasize energy conservation matters.

RECENTLY COMPLETED BUILDINGS USE MORE ENERGY THAN ESTIMATED

GSA's energy usage reports show that all of the six buildings completed since fiscal year 1979 have used significantly more energy than their designs indicated. In addition, GSA has established annual energy usage of 204,050 BTU/GSF at the source of energy as the fiscal year 1975 base for newly constructed

buildings. The amount of energy usage should be reduced by 45 percent to 112,228 BTU/GSF by fiscal year 1985. For fiscal year 1979, GSA's overall usage for new buildings was 136,964 BTU/GSF annually.

The annual energy usage for the six buildings completed since fiscal year 1979 exceeded their designed annual energy usage goal by at least 20 percent and up to 203 percent. The total cost for the energy used that exceeded the energy usage goals for these buildings amounted to about \$322,000 for fiscal year 1980 and \$427,000 for fiscal year 1981.

The table below compares for fiscal years 1980 and 1981 the annual energy usage at the energy source for these buildings with the annual energy source goal of 100,000 BTU/GSF. GSA reports energy usage at the energy sources for its buildings.

Comparison of Energy Used With Energy Usage Goals

For Fiscal Years 1980 and 1981 for Six

Buildings Completed Since Fiscal Year 1979

<u>Building</u>	<u>Date completed</u>	<u>FY 1980 energy usage</u> (BTU/GSF)	<u>Percent usage exceeded goal</u>	<u>FY 1981 energy usage</u> (BTU/GSF)	<u>Percent usage exceeded goal</u>
Federal Building, Courthouse and Parking Facility, Fort Lauderdale, Florida	Feb. 1979	183,186	83	156,826	57
Federal Building and Parking Facility, Norfolk, Virginia	Feb. 1979	125,477	25	119,776	20
Federal Building, Courthouse and Parking Facility, Anchorage, Alaska	Mar. 1979	157,983	58	157,222	57
Federal Building, Jackson, Mississippi	June 1979	150,176	50	137,628	38
Federal Building and Courthouse, Columbia, South Carolina,	Sept. 1979	144,850	45	158,505	59
Federal Building, Carbondale, Illinois	Feb. 1980	(a)		303,198	203

a/Energy usage data was not available.

GSA believes that the energy performances for these buildings are typical of buildings in the initial period of operations, and that malfunctioning solar equipment caused excessive energy usage in the Carbondale Federal Building.

GSA has been aware that excessive air infiltration has been a major problem in these buildings. Therefore, in May 1981, GSA entered into an agreement with NBS to develop diagnostic inspection procedures, measurement techniques, and interpretation methods for assessing the thermal integrity of Federal buildings. NBS completed its report in January 1982. GSA plans to use this report to implement an inspection program, in conjunction with other Government agencies, to evaluate the energy efficiency of the outside walls of newly constructed and existing Federal buildings.

INEFFECTIVE COMMUNICATIONS AMONG GSA'S CENTRAL OFFICE, ITS REGIONS, AND DESIGNERS

Ineffective communications among GSA's Central Office, its regions, and A/E firms regarding energy conservation has resulted in (1) A/E firms submitting unsatisfactory designs, (2) the regions not notifying the Central Office of actions taken to correct the deficiencies identified in the A/E firms' designs, and (3) the regions questioning some of GSA's assumptions for computing energy usage goals.

Unsatisfactory A/E firms' design submissions

GSA rejected A/E firms' predesign, concept, and tentative design products for the San Jose, Springfield, El Paso, and Boston projects because of serious deficiencies regarding energy conservation features.

San Jose project

The San Jose project was the first building that GSA required to meet the energy usage goals of 25,000 BTU/GSF at the building boundary and 73,000 BTU/GSF at the energy source rather than 55,000 BTU/GSF and 100,000 BTU/GSF. GSA agreed with the A/E firm to perform an energy study to determine if and how the goal could be achieved. On February 11, 1980, GSA awarded a letter contract to the A/E firm to start the energy study.

The A/E firm's conceptual design was rejected because of such problems as inadequate energy consumption and life cycle cost studies. The firm's third and final design was finally approved in August 1980. Although authorized to proceed with the tentative design phase, the firm was still required to correct the longstanding problems dealing with inadequate substantiation of the annual energy usage goal.

After rejecting the design again in November 1980 because of inadequate energy consumption and life-cycle cost studies, the GSA region approved the firm's tentative design in February 1981.

Springfield project

GSA's Central Office and the Boston Regional Office found the predesign program and design concept prepared by the A/E firm deficient because the concept did not contain definitive cost and energy estimates and a definition of the building's outer shell. According to GSA officials, the design did not reflect good energy conservation principles. In addition, the Regional Public Advisory Panel on Architectural and Engineering Services said that it was not convinced that energy was a sufficient design determinant.

The tentative design product prepared later by the A/E firm was rejected by GSA's Central Office because it concluded that the building design failed to meet GSA's energy objectives. GSA later directed the region to have the A/E firm correct the design features that contributed to energy waste.

El Paso project

GSA's Central Office reviewed the A/E firm's draft predesign program submission for the El Paso Federal Building and Parking Facility and recommended that it not be accepted because the design lacked detailed analysis of data and design direction. For example, the design did not fully consider passive and active solar systems, lighting levels, life cycle costing, and excessive energy usage due to computer operations.

Boston project

For the Boston project, GSA's Central Office reviewed the A/E firm's computerized preliminary energy analysis for the three design concepts. GSA rejected the energy analysis because:

- No allowance was provided for air infiltration.
- The space lighting load of 1.5 watts per square foot was excessive. It should have been 1.0 watts per square foot.
- The atrium lighting load of 10.0 watts per square foot was excessive.
- The rated tons of the refrigerator appeared to have been twice the expected load.
- The atrium skylight was single pane and double pane should have been considered.

--For the Boston climate, the envelope heat transmission co-efficient should have been 0.05 rather than 0.06.

--The variable air volume system appeared to have no return fans.

These deficiencies were corrected in the A/E firm's design concept.

Regions do not always respond to Central Office comments

GSA's Central Office may not always be aware of the disposition of its suggestions to the regional offices directing the A/E firms to correct energy conservation features in their designs. Although GSA's regions have primary responsibility for indepth reviews of A/E firms' predesign programs and designs, GSA's Central Office also reviews this data and provides suggestions to the regions for their consideration. GSA does not have a procedure requiring the regions to respond to Central Office comments. A Central Office representative said that, because the regions have the responsibility for successfully completing projects, the Central Office does not have the authority to require the regions to implement its suggestions.

San Francisco

The San Francisco regional office's chief of the Project Operations Branch said that the region does not always take action on all of GSA's Central Office comments mainly because of differences of opinion. For example, the Central Office commented that using ceiling return registers in the variable air volume system on the San Jose project was not proper because short cycling could occur. The Central Office strongly suggested the use of low side wall returns to force circulation down into space. The region, however, did not include this point in its drawing review comments to the A/E firm.

Boston

GSA's Central Office reviewed the Springfield project's A/E firm's tentative design and provided the Boston region with comments. The Central Office stated that the region should direct the A/E firm to correct the design features which contributed to energy waste. The region's chief of the Project Operations Branch sent the Central Office's review comments to the A/E firm for its review and evaluation. The region, however, instructed the A/E firm to consider in its design only those comments designated by the regional office. The regional chief of the Project Operations Branch was not aware of the A/E firm's actions on either the region's or Central Office's comments.

GSA's energy analysis assumptions
questioned by the regions and A/E firms

Officials of GSA's regional offices told us that they question some of GSA's Central Office energy analysis assumptions used to establish building energy usage goals. We believe, however, that regional office officials may not fully understand the assumptions used to establish the design energy goal for Federal buildings. For example, GSA's Central Office informs the regions to notify it immediately if the established building energy usage goals cannot be met, and it offers any necessary assistance to attain these goals. A GSA official said that, generally, the regions have not requested assistance or questioned the energy usage goals.

Energy usage goals for each new Federal building are computed by GSA's Central Office using standard assumptions as established in its preliminary energy analysis guideline. A GSA Atlanta regional office official, who was responsible for reviewing building project designs for energy conservation features, said that assumptions, such as a 10-hour day operation for lighting, infiltration loss of 0.025 cubic feet per minute per gross square foot, and no allowance for main frame computer operations, may not always be valid. Officials at the GSA Boston regional office also questioned the validity of applying to all buildings the 10-hour day operation for lighting and no allowance for main frame computer operations.

GSA'S COMMITMENT WEAK FOR IMPLEMENTING
POLICIES AND PROMOTING OPPORTUNITIES
AFFECTING ENERGY CONSERVATION

GSA has not committed sufficient resources to implement programs that affect energy conservation designs nor has it adequately emphasized energy conservation matters to insure that (1) the planned number of post-occupancy evaluations are made, (2) the procedures for implementing the revised policy to assure better quality of designs are completed promptly, (3) the regional staffs are trained to adequately review energy conservation features in designs, and (4) A/E firms are graded uniformly for energy conservation expertise.

Limited effectiveness of the
post-occupancy evaluation program

GSA's July 1980 policy directive for post-occupancy evaluations requires that completed Federal buildings be evaluated after a "reasonable shakedown period." Of the six Federal buildings completed since fiscal year 1979, GSA has made only one post-occupancy evaluation because of a lack of travel funds for staff to conduct evaluations.

The purpose of post-occupancy evaluations is to provide designers of other Federal buildings with data in the areas of design development, construction costs, energy conservation, user environment, and urban relationships. GSA considers the post-occupancy evaluations of completed buildings important because they supplement the inspections made during construction. They will help GSA ensure that projects are constructed in accordance with the design requirements and provide GSA with data useful for improving requirements and procedures for designing other buildings. For example, according to GSA, the post-occupancy evaluation of the New Orleans Federal Building and Courthouse significantly saved energy. GSA identified and corrected an improperly installed and operated heating, ventilating, and air-conditioning system. As a result, severe discomfort of the occupants was alleviated and energy costs were reduced \$200,000 annually for life-cycle savings of \$6 million.

The Design Evaluation Branch within the Office of Design and Construction is responsible for conducting post-occupancy evaluations. The Branch had planned to evaluate six buildings in fiscal years 1981 and 1982; however, GSA provided funds that allowed the Branch to evaluate only two buildings each of these 2 years. Starting in fiscal year 1978, two buildings were evaluated, in fiscal year 1979, four buildings were evaluated, and in fiscal year 1980, no buildings were evaluated.

In July 1980, we reported 1/ that although the regions were expected to provide staff to conduct the post-occupancy evaluations, this would not occur until sometime in 1982 after instructions for conducting the evaluations were completed. We also stated that with proper implementation of the post-occupancy program, benefits could be achieved in the following four areas.

- Identifying problems in need of corrective action in the evaluated facility.
- Identifying poor design features or problems resulting from deficiencies in the design work or review.
- Identifying design strengths or other features for incorporation in future work.
- Stimulating continuous review and improvement of GSA's system of design and construction guidance (for example, handbooks and specifications).

We believe, however, that a complete program evaluation cannot be made until the program is fully implemented at the regional office level.

1/"GSA's Planned Program to Evaluate Completed Construction Projects Can Benefit Future Construction" (PLRD-81-56, dated July 27, 1981).

Delay in completing implementation
revised policies for processing designs

Budget restrictions have resulted in GSA's delaying the implementation of its policy directive dated July 30, 1980, which revises the Public Buildings Service's policies for managing the process for controlling the quality of design and construction of new buildings. GSA had planned to contract for the preparation of a handbook which would establish the criteria and responsibilities implementing the new policy. The handbook was planned for completion during October 1980 through December 1981. However, completion has been delayed to about the end of fiscal year 1982 because, according to a GSA representative, budget restrictions have caused GSA to shift the work from contract to GSA for the volumes on predesign programming, design, and post-occupancy evaluation.

GSA's revised policy is an attempt to ensure that its design, construction, and operating criteria would be met in each new building by requiring indepth analyses by GSA's regions, with guidance from its Office of Design and Construction. These analyses are to be conducted at four critical stages: predesign programming, design review, construction performance, and post-occupancy evaluation.

In fiscal year 1980 GSA decided that it needed a more realistic approach to manage the process for designing and constructing new buildings. This decision was based on its review of the design and construction process which showed that greater energy efficiency, cost savings, and space flexibility would have been realized over the life cycle of buildings if the mechanical and electrical systems, structural components, space layouts, and architectural features had been properly designed, constructed, and operated. GSA stated that problems occurred in these areas because it relied solely on the professional judgments of A/E firms to satisfy office space needs. This occurred because GSA did not have a mechanism for (1) instructing regional staffs and A/E firms how to appropriately develop designs for Federal buildings, (2) evaluating final products, or (3) obtaining feedback data on experiences gained from the development, design, construction, and operation of buildings.

Regions lack knowledge
of energy conservation
technology

GSA's revised policy for managing the design process requires indepth reviews by the regions. However, indications are that the regions do not have the technical knowledge necessary to review A/E firms' designs for energy conservation features.

GSA staff members at the Boston and San Francisco regional offices said that, generally, they lack sufficient technical knowledge to adequately review the A/E firms' computer analyses for

building energy consumption. Therefore, these analyses generally are accepted without a regional review. Central Office representatives said that regional staff do not always have sufficient knowledge of energy conservation technology to assure that A/E firms' design submissions reflect all of GSA's energy conservation requirements.

Lack of a systematic grading method for energy conservation when selecting A/E firms

The regions do not place the same degree of emphasis on energy conservation matters when selecting A/E firms. In five GSA regions, four different value points were used when the regions selected the A/E firms for the six building projects we reviewed. On a scale of 1 to 100, the maximum points established for energy conservation varied from 3 to 10 as follows: Springfield, 3 points; Boston and Jamaica-Queens, 5 points; San Jose, 6 points; and Savannah and El Paso, 10 points each.

GSA representatives said that evaluations for energy conservation expertise should vary by project because of the differences in the types and locations of buildings. However, the highest value of 10 may be only marginal for some projects, and according to the representatives, a range of values would help equalize ratings for energy conservation expertise when regions select A/E firms.

CONCLUSIONS

GSA has taken actions to improve energy conservation in future and existing buildings. Actions include basing energy usage budgets on local conditions and current technology, developing procedures to diagnose air infiltration in buildings, and realining responsibilities for managing the overall quality of designs. These actions are first steps; however, significant benefits may not be forthcoming unless GSA takes additional steps to improve communications among A/E firms and GSA offices. In addition, GSA should commit sufficient resources to implement programs that affect energy conservation designs and adequately emphasize energy conservation matters.

Ineffective communications regarding energy conservation requirements among GSA's Central Office, its regional offices, and A/E firms is one reason why the firms are submitting unsatisfactory energy conservation designs. This condition exists even though GSA has issued guidelines and criteria for its energy conservation requirements and offers any assistance necessary to help A/E firms achieve the building energy usage goals.

Another contributing factor causing unsatisfactory designs is that regions, in reviewing A/E firms' design submissions, generally do not have adequate knowledge of energy conservation

technology to assure the submissions comply with GSA requirements. This point is important for implementing GSA's revised management of the design process because the regions are responsible for conducting indepth reviews of A/E firms' design submissions.

Other factors that contribute to unsatisfactory designs and that need to be improved are (1) the Central Office having no assurance that problems identified will be solved because the regions are not required to implement the corrective actions, (2) the failure to conduct all planned post-occupancy evaluations, (3) the delay in completing the instructions implementing the revised management for processing designs, and (4) the lack of a standard for evaluating energy conservation expertise when selecting A/E firms.

Because of budget restrictions, GSA needs to place more empnasis on the program to improve the design process, so that new Federal buildings are energy efficient. Therefore, the Administrator of General Services should identify the specific needs of his energy design review staff and provide the training necessary to fulfill their educational needs and take steps to complete and implement the procedures for controlling the quality of designs so that new Federal buildings are designed to conserve energy.

RECOMMENDATIONS

In placing priority on the Public Buildings Service's programs, the Administrator of General Services should require the Commissioner, Public Buildings Service, to:

- Provide the training necessary in GSA's energy conservation requirements and state-of-the-art energy conservation technology for the regional energy design review staff to perform their duties.
- Promptly implement the procedures for the revised policy to improve the quality of designs.
- Implement the post-occupancy evaluation program with specific attention to energy conservation matters.
- Establish a standard, with minimum and maximum values, for evaluating energy conservation expertise when selecting A/E firms.

AGENCY COMMENTS AND OUR EVALUATION

GSA agreed to provide the training necessary for the regional energy design review staff to perform their duties and implement the post-occupancy evaluation program. However, GSA did not address the problem that it said prevents it from making these programs successful, which is the lack of travel funds. We continue

to believe that GSA should provide the training and post-occupancy evaluations required to improve the situation.

GSA also said that our recommendation to implement the procedures for the revised policy to improve the quality of designs urges the timely completion of its handbooks. GSA said these handbooks will soon be completed. We point out, however, that just as important as completing the handbooks is the timely implementation of the revised procedures included in the handbooks. As pointed out in this chapter, these new procedures require in-depth analyses by GSA's regions; however, regions do not have the expertise to adequately review A/E firms' designs for energy conservation features. Therefore, we believe a training program will be essential to GSA's effectively implementing its new procedures.

GSA's April 1, 1982, policy (see app. II) on procedures for reviewing design concepts should help assure that better designs are prepared. The new policy requires that GSA's regions not select nor approve any concept design without concurrence by the Central Office's newly established Project Planning Review Board. To help ensure that energy conservation features are adequately considered in designs, we continue to believe that GSA should implement the procedures for the revised policy as soon as possible.

GSA also agrees with the intent of our recommendation to establish a standard, with minimum and maximum values, for evaluating energy conservation expertise when selecting A/E firms. GSA said, however, that it is reluctant to establish a minimum value because this might inappropriately become the maximum for some projects. Therefore, GSA will explore alternative methods for increasing the emphasis on energy expertise. We believe GSA's concern that minimums may become maximums is valid. However, until GSA establishes an alternative method, we continue to believe that GSA needs standard values for its regions to use in evaluating prospective A/E firms' energy conservation expertise.

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3. Kusuda, T., Liu, S.T., Bean, J.W., and Barnett, J.P., "Analysis of the Solar Energy System for the GSA Demonstration Office Building in Manchester, New Hampshire," NBS Report NBSIR 76-1056, March 1976.
4. Hunt, C.M., "Air Exchange and Ventilation System Measurements in the Norris Cotton Federal Office Building in Manchester, New Hampshire," Letter Report to Department of Energy (DOE), May 1977.
5. Hill, J.E., and Richtmyer, T.E., "Thermography Measurements in the Norris Cotton Federal Office Building in Manchester, New Hampshire," Letter Report to DOE, August 1977.
6. Elder, J., "Norris Cotton Federal Building--User Acceptance," Letter Report to DOE, February 1978.
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8. Elder, J., "Norris Cotton Federal Building User Acceptance--Results of the Second Questionnaire," Letter Report to DOE, March 1978.
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10. Richtmyer, T.E., "The Use of Computer-Controlled Data Acquisition Systems in Determining Solar Heating and Cooling System Performance," Proceedings of the Conference on Performance Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems held in Washington, D.C., April 1978.
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15. Hunt, C.M., and Richtmyer, T.E., "Remeasurement of Air Exchange Rates in the Norris Cotton Federal Office Building After Retrofitting to Reduce Leakage," Letter Report to DOE, April 1979.
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20. May, W.B., "Analysis of Data from the Energy Monitoring and Control System at the Norris Cotton Federal Office Building," NBS Report NBSIR 81-2358, September 1981.



General
Services
Administration

Washington, DC 20405

MAY 10 1982

Honorable Charles A. Bowsher
Comptroller General of the United States
General Accounting Office
Washington, DC 20548

Dear Mr. Bowsher:

The draft of a proposed report, Code 94585, entitled "Improved Design Efforts By GSA Needed To Incorporate Energy Conservation Features Into New Federal Buildings" is a conscientious effort to understand and critique a highly complex technical subject.

We are in general agreement with most of the report's recommendations. Specific comments on the recommendations and general comments on technical irregularities within the report are provided in the enclosure to this letter.

My staff enjoyed a candid working relationship with your investigators and appreciate the emphasis shown on this important subject. We look forward to the final report and trust our comments will prove constructive.

Sincerely,

Ray Kline
Deputy Administrator

Enclosure

02 MAY 13 1982 A10: 65

GENERAL SERVICES ADMINISTRATION
COMMENTS ON GENERAL ACCOUNTING OFFICE
REPORT - 25 - 2031 - P

Title of Report: Improved Design Efforts By GSA Needed To Incorporate
Energy Conservation Features Into New Federal Buildings

GENERAL COMMENTS

1. We suggest the title of the report be changed to "Improved Design Efforts By GSA Needed To Enhance Energy Conservation In New Federal Buildings." This would reflect the fact that energy conservation features have previously been applied to our new buildings.
2. The information value of the Norris Cotton Federal Building should be de-emphasized. Many of the applied design features of this nine year old building are no longer current or cannot be transferred to buildings in other climates. Those design features which are transferable, such as infiltration and envelope design, are already documented or will be in the new Design Management Series.
3. We disagree with the statement on pages vi. and 8 of the report that "GSA has been rejecting architect-engineers (AE) firms' design submissions because of inadequately designed energy conservation features which are for the same types of features that were developed in the Norris Cotton Federal Building" and the further implications throughout the report that these actions could have been avoided if GSA had communicated to AE firms the experiences gained from the "Manchester" project.

Although a single Manchester comparison was made for the lighting system to the Springfield Federal Building, there have been no other instances where Manchester experiences were referenced or could have been referenced as a source of rejection to recent building designs. Also, as acknowledged in the report, unacceptable energy conservation features were not the only reason that those designs were rejected.
4. The report contains several references implying that architect-engineer designs are rejected solely for energy conservation reasons. Designs are, in fact, rejected for failure to meet any program objectives not just energy conservation.
5. References in the report to co-generation as a recognized means of achieving energy conservation should be removed. Co-generation is a viable design feature only if a constant electric load, such as a major computer presence, exists.
6. The table on page 20 of the report correctly indicates the poor, though in most cases improving, energy use performance of six new buildings. However, the report should also indicate that such performance is typical of buildings in the "shakedown" period of operation. References to the Carbondale Federal Building energy use, in particular, should cite the malfunction of the solar support equipment as the principal cause.
7. The report makes unqualified references to the former GSA energy use goal of 100,000 BTU/GSF. This goal was never intended to, or could it ever, be a forecasting target against which actual performance is measured. The inability to forecast building performance was a principal reason for the 1978 policy change to providing individual building performance goals.

2

8. The GAO, in a final report, may wish to note a new policy statement dated April 1, 1982, which offers the Central Office an opportunity to insist upon adherence to design policies essential to programs such as energy conservation. Specifically, concept designs prepared by contract architect-engineers are not to be selected or approved without Central Office concurrence.

9. The five volume handbook referenced on page 29 of the report is now a four volume handbook. Two of the volumes have been combined.

GAO Recommendation: Provide the training necessary in GSA's energy conservation requirements and state-of-the art energy conservation technology for the regional energy design review staff to perform their duties.

GSA Response: We are in substantial agreement with this recommendation. Indeed, in 1980, the Office of Design and Construction (ODC) conducted a series of Design Technology Workshops to emphasize specific program areas including energy conservation. Energy program policy, life cycle costing, "lessons learned," and design concepts were all presented in an intensive one week course. All GSA regions attended. Funding and travel limitations have prohibited a second offering.

A training program was initiated for Fiscal Year 1982, wherein the Central Office could select, fund, and coordinate training for regional staff. Basic engineering and technical design courses were identified as the best way of ensuring energy conscious design. Although adequately funded for course fees, travel funding limitations have restricted rigorous program development.

A one week "Quality Control Course," to be conducted by ODC, is scheduled for June of this year. Again, travel limitations are such that only those regions with pending new construction projects will be able to attend.

A new quarterly publication, "Dimensions," is intended to provide an informal means of communicating technical information to and among the regional Design and Construction Divisions. The first issue, scheduled for publication in June, will feature a section on energy related technical issues.

GAO Recommendation: Implement the procedures for the revised policy to improve the quality of designs in a timely manner.

GSA Response: This recommendation urges the timely completion of a multi-volume set of GSA handbooks, the Design Management Series. These detailed design policies and criteria will soon be available to aid in assuring better quality design. As noted in the GAO report, funding restrictions have forced a major portion of the effort to be assumed by ODC staff.

Volume I, Quality Standards for Design and Construction, is now in final typing. Volume II, Design Programming for Public Buildings, was prepared by a professional services contractor and is now being edited by ODC staff. Volume III, Preparation of Construction Specifications for PBS Projects, has been issued and is in place as a working document. Volume IV, Post-Occupancy Evaluation, is currently being developed by ODC staff.

GAO Recommendation: Implement the post-occupancy evaluation program with specific attention to energy conservation matters.

GSA Response: We agree with this recommendation. Our staff shares the GAO's conviction that there are benefits to be gained from the post-occupancy evaluation program. Past post-occupancy evaluations have addressed some energy related deficiencies and future evaluations can be targeted to specific conservation problems. The purchase of expensive field testing apparatus will be required to address energy use in a quantitative manner.

In 1983, the National Bureau of Standards, through a formal agreement with GSA, will study three of the six new buildings mentioned in the GAO report. The three buildings are the Federal Building and Courthouse, Columbia, SC; Federal Building, Courthouse, and Parking Facility, Anchorage, AK; and Federal Building and Parking Facility, Norfolk, VA. These buildings will be studied as the applied research phase in development of a diagnostics program. The buildings were purposefully selected to ensure a post-occupancy evaluation type of review on the thermal integrity of the building envelope.

GAO Recommendation: Establish a standard with minimum and maximum values for evaluating energy conservation expertise when selecting architect-engineer firms.

GSA Response: We are in agreement with the intent of this recommendation: raise the relative emphasis placed on energy conservation during the architect-engineer selection process. As pointed out in the GAO report, evaluations for energy conservation expertise vary from project to project because of the differences in the types and locations of buildings. We are reluctant to establish a minimum which might then become a maximum inappropriate for some projects. We will explore alternative methods for increasing the emphasis on energy expertise.

GAO Recommendation: Summarize the evaluations of the Norris Cotton Federal Building and provide this to designers of other Federal buildings.

GSA Response: We do not agree with this recommendation. The Norris Cotton Federal Building has been extensively studied by the National Bureau of Standards (NBS) and fully documented in two NBS publications, Building Science Series 130 and 133. These recently published documents will be sent to all GSA regions as information. Some widely known and well documented problem areas, such as envelope infiltration, can be emphasized through these documents. However, many design elements of the Norris Cotton Federal Building cannot, and should not, be transferred to other buildings in other climates. Indeed, many design applications used in that building are in conflict with current state-of-the art. Therefore, we will not issue Building Science Series 130 and 133 as references to our contract architect-engineers. Also, see general comments numbered 2 and 3 on previous page.

GAO Recommendation: Incorporate into the energy conservation guidance provided architect-engineer firms experience gained on projects completed after the Norris Cotton Federal Building.

GSA Response: We agree with this recommendation. The previously mentioned Design Management Series is structured to allow quick and easy updating of design criteria as the state-of-the art changes. Therefore, the results of post-occupancy evaluations can, where appropriate, be readily translated into design criteria and be transmitted to our regional offices and contract architect-engineers.



General Services Administration
Public Buildings Service

Washington, DC 20405

Date **APR 1 1982**
 Reply to Attn of: Assistant Commissioner for Design and Construction - PC
 Subject: Design Concept Reviews for New Construction and Designated R & A Projects
 To: Regional Administrators
 WA, 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A, 9A, 10A

Recent experience with several major projects in progress has indicated some serious problems in design at the completion of the concept phase. Some of these problems have been resolved prior to formal concept approval through comprehensive review and cooperative efforts between regional and Central Office architects and engineers. Current organizational procedures relative to projects are based on informal relationships between the Central Office (PBS) as the Program Manager and the cognizant operational offices.

Some of the design problems could have been avoided by earlier involvement by the Central Office in the formative stages of concept design. A recent change to the GSA Handbook "Instructions to Contract Architects-Engineers (A-E)" emphasizes the importance of our consultants providing a minimum of three preliminary "sketch" concepts prior to the region's selection of a final concept. This should help "flush out" major problems prior to the A-E becoming too committed to a specific design or applying too much time and money to an approach which may not be acceptable to GSA.

In order to ensure a unified GSA position on design issues or problems and to avoid time delays and associated cost, it is important that the regions facilitate the timely involvement of the Central Office during the formative stages of concepts. This should prevent major problems showing up in the final concepts of tentative stages of design development. A standing committee of the Project Planning Review Board (PPRB) has been established, chaired by the board member from the Office of Design and Construction (PC). This committee will review and comment upon concepts and tentatives for new construction and designated R & A projects. A concept should not be selected nor approved prior to the committee's review and concurrence.

I have directed the Assistant Commissioner for Design and Construction to ensure that the Central Office review will be expeditious and communicated back to the regional office within seven working days of the receipt of concept submittals. Informal pre-concept review sessions between the regional and Central Office professionals should also be encouraged.

GSA as a client has a major responsibility for the success of its design and construction program, whether developed "in-house" or by consultant resources. Through the complete cooperation of the Central Office and the operational regional office this success can be achieved.



RICHARD O. HAASE
Commissioner

cc: Assistant Regional Administrators
WP, 1P, 2P, 3P, 4P, 5P, 6P, 7P, 8P, 9P, 10P
Associate Administrator for Operations - AR



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